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Subterranean Philosciidae from Spain with the description of a new genus and two new species (Crustacea, Isopoda, Oniscidea)*

Lluc Garcia[1,2], Adrià Miralles-Núñez[3], Antonio Cruz-Suárez[4]

1 *MUCBO-Museu Balear de Ciències Naturals, Sóller (Mallorca), Balearic Islands, Spain* **2** *Interdisciplinary Ecology Group, University of the Balearic Islands (UIB), Palma de Mallorca, Spain* **3** *Servei de Fauna i Flora, Departament de Territori, Habitatge i Transició Ecològica, Generalitat de Catalunya, Barcelona, Spain* **4** *Departament de Biologia Animal (Zoologia), Facultat de Biologia, Universitat de Barcelona, Barcelona, Spain*

Corresponding author: Lluc Garcia (llucgarciaisopoda@gmail.com)

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Abstract

A new genus and two new species of terrestrial cave-dwelling isopods from the eastern Iberian Peninsula and the Balearic Islands, belonging to the family Philosciidae Kinahan, 1857, are described and fully illustrated. *Iberoscia* **gen. nov.** is erected to accommodate *Iberoscia zaragozai* **sp. nov.** from Catalonia, Murcia and the Valencian Community. Furthermore, the genus *Paractenoscia* Taiti & Rossano, 2015 is recorded for the first time in the Ibero-Balearic region with the description of a new species from Ibiza (Balearic Islands). Moreover, the male of *Anaphiloscia simoni* Racovitza, 1907, is illustrated for the first time based on topotypical specimens from Mallorca, and *Anaphiloscia sicula* Arcangeli, 1934, is proposed here as a subjective junior synonym of this species. Finally, the monotypic genus *Parachaetophiloscia* Cruz & Dalens, 1990, is revised and proposed as a subjective junior synonym of *Chaetophiloscia* Verhoeff, 1908.

Keywords

Balearic Islands, cave-dwelling isopods, Crinocheta, Iberian Peninsula, Philosciidae, taxonomy

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Introduction

Philosciidae is one of the most diverse families within Oniscidea. The family currently includes 114 genera, most of them monotypic, and 503 valid species (excluding fossil, uncertain taxa and *species inquirendae*) (Hartebrodt et al. 2023; Boyko et al. 2025). The vast majority of Philosciidae inhabit the intertropical zone (Schmalfuss 2003; Taiti 2004); however, representatives of this family are much rarer in the Holarctic region.

In the European and Mediterranean regions (Europe, North Africa and the Middle East), about 60 species included in ten genera have been described to date (valid subspecies excluded) (Schmalfuss 2003; Boyko et al. 2025). Only four genera in the region include subterranean or cave-dwelling species: *Anaphiloscia* Racovitza, 1907; *Paractenoscia* Taiti & Rossano, 2015; *Parachaetophiloscia* Cruz & Dalens, 1990; and *Aracenoscia* Cifuentes & Beruete, 2025. *Anaphiloscia* includes two blind species (*A. simoni* Racovitza, 1907 and *A. sicula* Arcangeli, 1934), which have been considered epigean by some authors, although in the western Mediterranean, they have only been recorded from caves. *Paractenoscia* includes a single troglobiont species, *P. cavernicola* Taiti & Rossano, 2015, from Morocco. *Parachaetophiloscia* is represented by *P. levantina* Cruz & Dalens, 1990, from the eastern Iberian Peninsula. *Aracenoscia* Cifuentes & Beruete, 2025, from southwestern Spain, includes *A. cavernicola* Cifuentes & Beruete, 2025 as its type species. The remaining genera present in the region comprise only occasional cave-dwelling (troglophilic), litter-dwelling or subcorticolous species, such as *Chaetophiloscia* Verhoeff, 1908, *Ctenoscia* Verhoeff, 1928, *Lepidoniscus* Verhoeff, 1908, *Philoscia* Latreille, 1804, *Tiroloscia* Verhoeff, 1926, and *Trichophiloscia* Arcangeli, 1950 (Vandel 1960, 1962; Schmölzer 1965; Gruner 1966; Schmalfuss 1990a, 1990b, 1991, 2003; Gardini et al. 2025).

Despite this diversity, subterranean Philosciidae in the Ibero-Balearic region remain poorly known, with few described species and a limited understanding of their taxonomy and distribution. Here, we describe new taxa, provide new morphological data, and reassess the taxonomic status of selected genera and species, contributing to a better understanding of the group in the region.

Material and methods

The studied material comes from subterranean cavities located in the eastern part of the Iberian Peninsula (Catalonia, Murcia and Valencia) and the Balearic Islands (Fig. 1). The specimens were collected during various biospeleological surveys carried out between 1966 and 2025, by the authors or collaborators. Unless otherwise indicated, they were captured directly by hand and preserved in 75% ethanol. Specimens were dissected under a stereomicroscope (Euromex Nexius). Body parts were treated with Aman's lactophenol and mounted on slides using glycerine jelly and the coverslips were sealed using nail polish. Drawings were made with the aid of a camera lucida mounted on an Olympus CH30 microscope. Final illustrations were prepared with the GIMP software (Montesanto 2015). Descriptions are based exclusively on morphological characters. Photographs of live specimens of *Anaphiloscia simoni* and *Iberoscia zaragozai* gen. nov. et

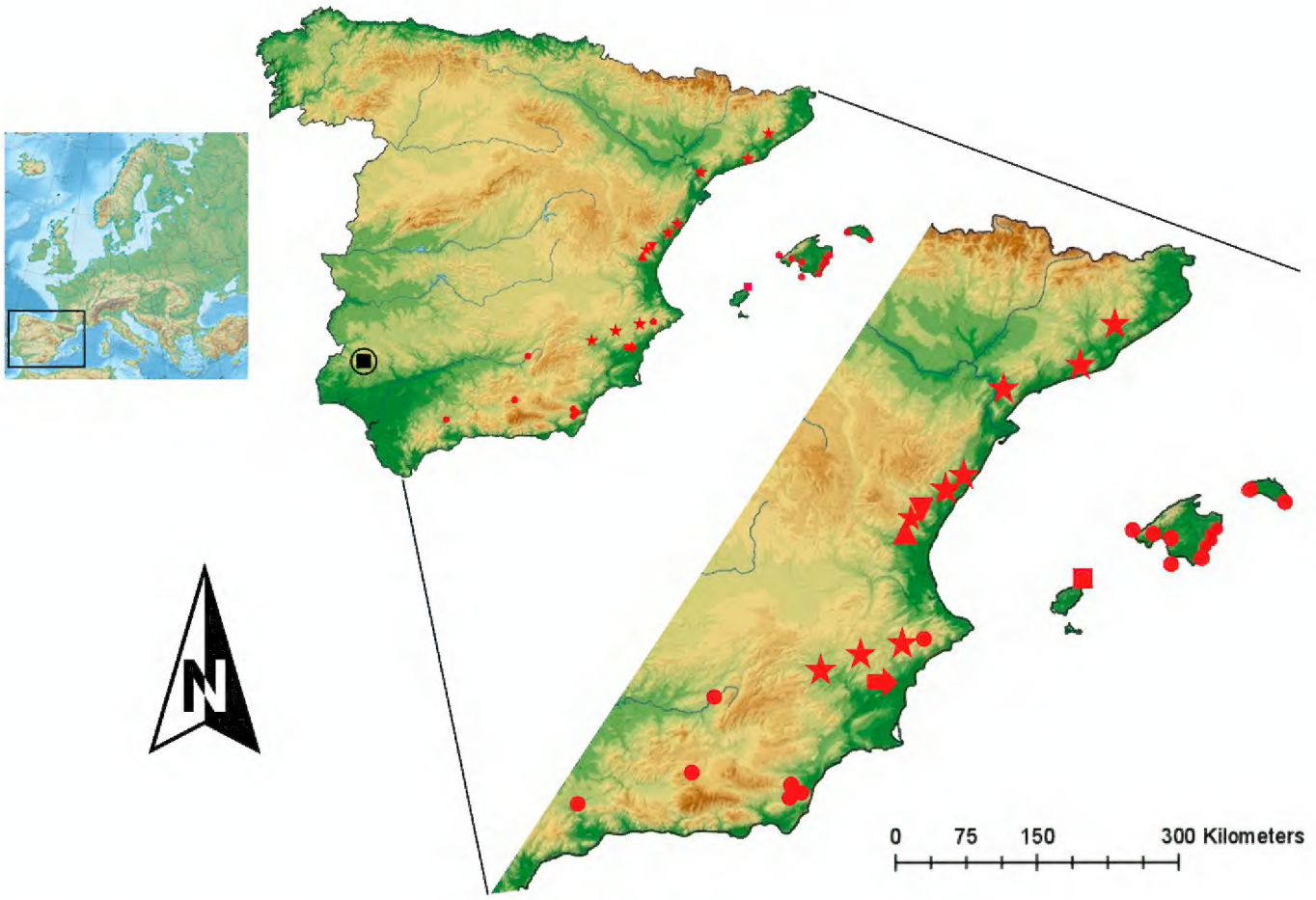

Figure 1. Map showing approximate locations of studied or discussed species in the Iberian Peninsula and the Balearic Islands. Circles: *Anaphiloscia simoni*. Square: *Paractenoscia sendrai* sp. nov. Triangle: *Paractenoscia* sp. A. Inverted triangle: *Paractenoscia* sp. B. Arrow: *Chaetophiloscia levantina* comb. nov. Stars: *Iberoscia zaragozai* gen. nov. et sp. nov. Circled square: *Aracenoscia cavernicola*.

sp. nov. were taken *in situ* (by the second author, A.M.N.) with a Nikon D7500 camera equipped with a 105 mm Nikkor lens. In addition, a live specimen of *Parachaetophiloscia levantina* was photographed in its type locality by José Vegara Pozuelo. The type material has been deposited in the following institutions or collections.

CRBA Centre de Recursos de Biodiversitat Animal. Universitat de Barcelona, Spain

MBCN Museu Balear de Ciències Naturals (Fundació MUCBO), Sóller, Mallorca, Spain.

CLLG Lluc Garcia, personal collection.

Taxonomy

Family Philosciidae Kinahan, 1857

Genus *Anaphiloscia* Racovitza, 1907

Type species. *Anaphiloscia simoni* (Racovitza 1907, p. 183–189; figs 132–164).

Diagnosis. Racovitza 1907, p. 182.

Anaphiloscia simoni Racovitza, 1907

Figs 2–4, 15A

Anaphiloscia sicula, Arcangeli 1934; p. 152–158; figs 1–19; new synonymy.
? *Anaphiloscia sicula*, Vandel 1946; p. 202–208; figs 50–59 (see remarks).

Material examined. Spain – Balearic Islands • 1 ♂, 2 ♀♀; Coves del Drac (Manacor, Mallorca); 1.04.2024; leg. Alberto Sendra; CLLG 1311 • 2 ♀♀, 1 immature; Coves del Drac (Manacor, Mallorca); 18.01.2025; leg. Alberto Sendra and Ferran Palero; CLLG • 2 ♀♀; Cova de Canet (Esporles, Mallorca); 20.05.1979; leg. Jaume Damians; CLLG 1328 • 1 ♂, 2 ♀♀; Cova des Riuet (Manacor, Mallorca); 16.02.2011; leg. Mateo Vadell; CLLG • 8 ♀♀; Cova den Passol (Felanitx, Mallorca); without date; leg. Mateo Vadell; CLLG • 1 ♀; Cova des Genet (Manacor, Mallorca); 9.09.2010; leg. Mateo Vadell; CLLG • 1 ♀; Avenc des Verdet (Calvià, Mallorca); 21.03.2010; leg. Mateo Vadell; CLLG • 1 ♂, 2 ♀♀; Cova des Moro (Dragonera); 21.11.2019; leg. Angel Ginés; CLLG • 10 ♀♀; Cova de Sa Llumeta (Illa des Conills, Cabrera), 19.03.1994; leg. Guillem X. Pons; CLLG • 1 ♂, 4 ♀♀; Cova des Burrí (Cabrera), 18.03.1994; leg. Guillem X. Pons; CLLG • 1 ♂; Avenc d'en Corbera (Esporles, Mallorca); 3.01.1980; leg. Oleguer Escolà; CRBA 85228 • 5 ♂♂, 6 ♀♀, Coves del Pirata (Manacor, Mallorca); 10.04.1974; leg. M. Romero; CRBA 91155 • 1 ♂; Cova Ses Figueres (Sant Lluís, Menorca); 29.12.1987; leg. Xavier Bellés; CRBA 85223 • 2 ♀♀; Cova de sa Tauleta (Ciutadella, Menorca); 31.12.1987; leg. Xavier Bellés; CRBA 85229. – **Alicante** • 1 ♂, 2 ♀♀; Font de la Llobera (Xixona); 1.11.1977; leg. Oleguer Escolà; CRBA 85226, CRBA 85227 • 1 ♂, 1 ♀; Cova de la Pinta Misteriosa (Callosa d'en Sarrià); 29.06.1968; leg. C. Alcoy; CRBA 85224, CRBA 85225. – **Almería** • 1 ♀; Covadura (Sorbas); 24.05.2001; leg. C. Ruiz-Portero; CLLG • 1 ♀; Complejo GEP (Sorbas); 5.04.2000; leg. C. Ruiz-Portero; CLLG • 2 ♂, 3 ♀♀; same locality, 23.01.2001; leg. C. Ruiz-Portero; CLLG • 2 ♀♀; Sima Termal (Sierra de Gádor); 12.11.2000; leg. Pardo-Piquer; CLLG. – **Jaén** • 4 ♀♀; Cueva de la Morciguilla (Villacarrillo); 24.03.2002; leg. Toni Pérez-Fernández/G.E.V; CLLG • 1 ♂, 6 immature; same locality; 24.02.2013; leg. Toni Pérez-Fernández/G.E.V.; CLLG 349. – **Málaga** • 8 ♀♀; Cueva del Yeso III (Antequera); 25.04.2008; leg. Toni Pérez-Fernández/G.E.V.; CLLG • 7 ♀♀; same locality; 28.09.2008; leg. Toni Pérez-Fernández/G.E.V.; CLLG • 1 ♂, 6 ♀♀; same locality; 29.03.2008; leg. Toni Pérez-Fernández/G.E.V.; CLLG 183.

Remarks. Racovitza (1907) established the genus *Anaphiloscia* and described *Anaphiloscia simoni*, from a female specimen (3.5 mm in length) collected in a cavity on the island of Mallorca (Balearic Islands). Therefore, the male sexual characters of this species have remained unknown until now. Topotypical and near-topotypical specimens from Mallorca and surrounding islets (i.e., Dragonera and Cabrera islands), and Menorca, have been examined and a male specimen (4.4 mm in length) collected at the type locality has been fully illustrated. In addition, specimens from various cavities in the Iberian Peninsula, mainly from the Levantine region and Andalusia, have been examined. They exhibit slight morphological differences, mainly in the number

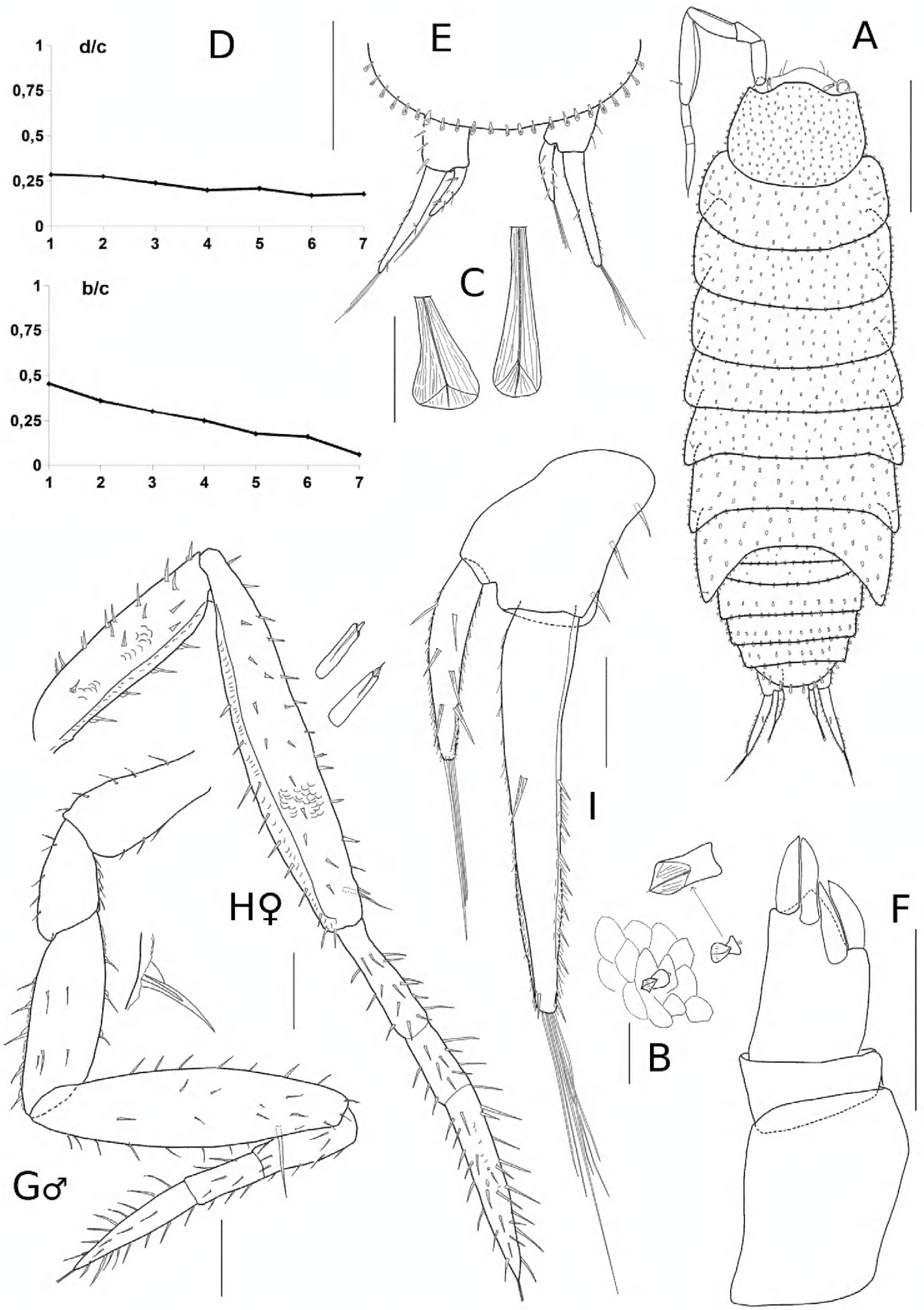

Figure 2. *Anaphiloscia simoni* Racovitza, 1907, Coves del Drac, Mallorca (CLLG 1311). **A.** Male habitus, dorsal; **B.** Dorsal scale-setae; **C.** Pleotelson marginal scale–setae; **D.** d/c and b/c index; **E.** Pleotelson and uropods, dorsal. **F.** First antenna; **G.** Male second antenna; **H.** Female second antenna; **I.** Right uropod, dorsal. Scale bars: 1 mm (**A**); 0.03 mm (**B**); 0.025 mm (**C**); 0.4 mm (**E**); 0.05 mm (**F**); 0.1 mm (**G–I**).

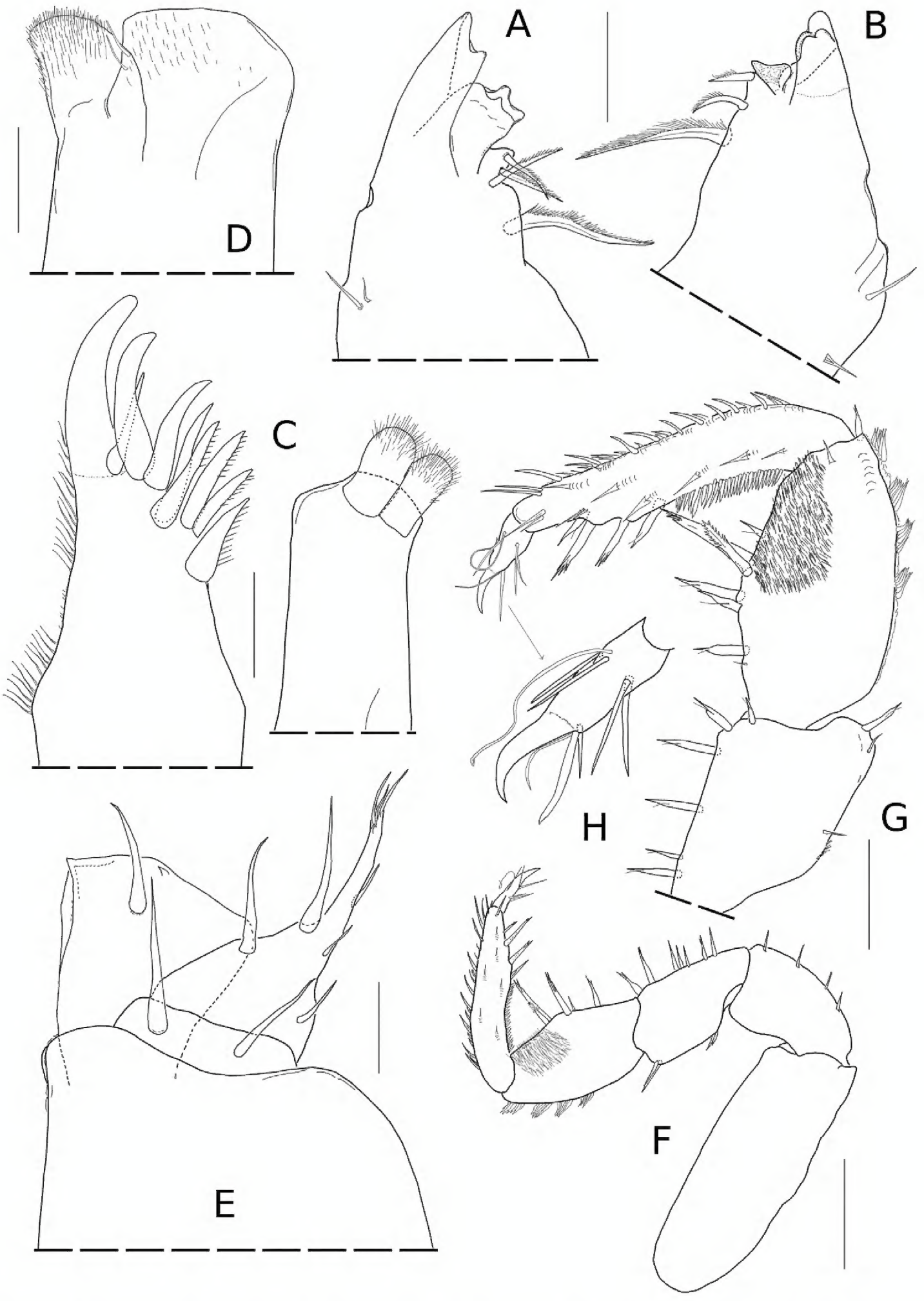

Figure 3. *Anaphiloscia simoni* Racovitza, 1907, Mallorca. **A.** Left mandible; **B.** Right mandible; **C.** Maxillule outer (left) and inner (right) branches; **D.** Maxilla; **E.** Maxilliped; **F.** Male pereopod 1; **G.** Male pereopod 1: merus, carpus, propodus and dactylus; **H.** Dactylus morphology. Scale bars: 0.07 mm (**A, B**); 0.03 mm (**C–E**); 0.15 mm (**F**); 0.08 mm (**G**).

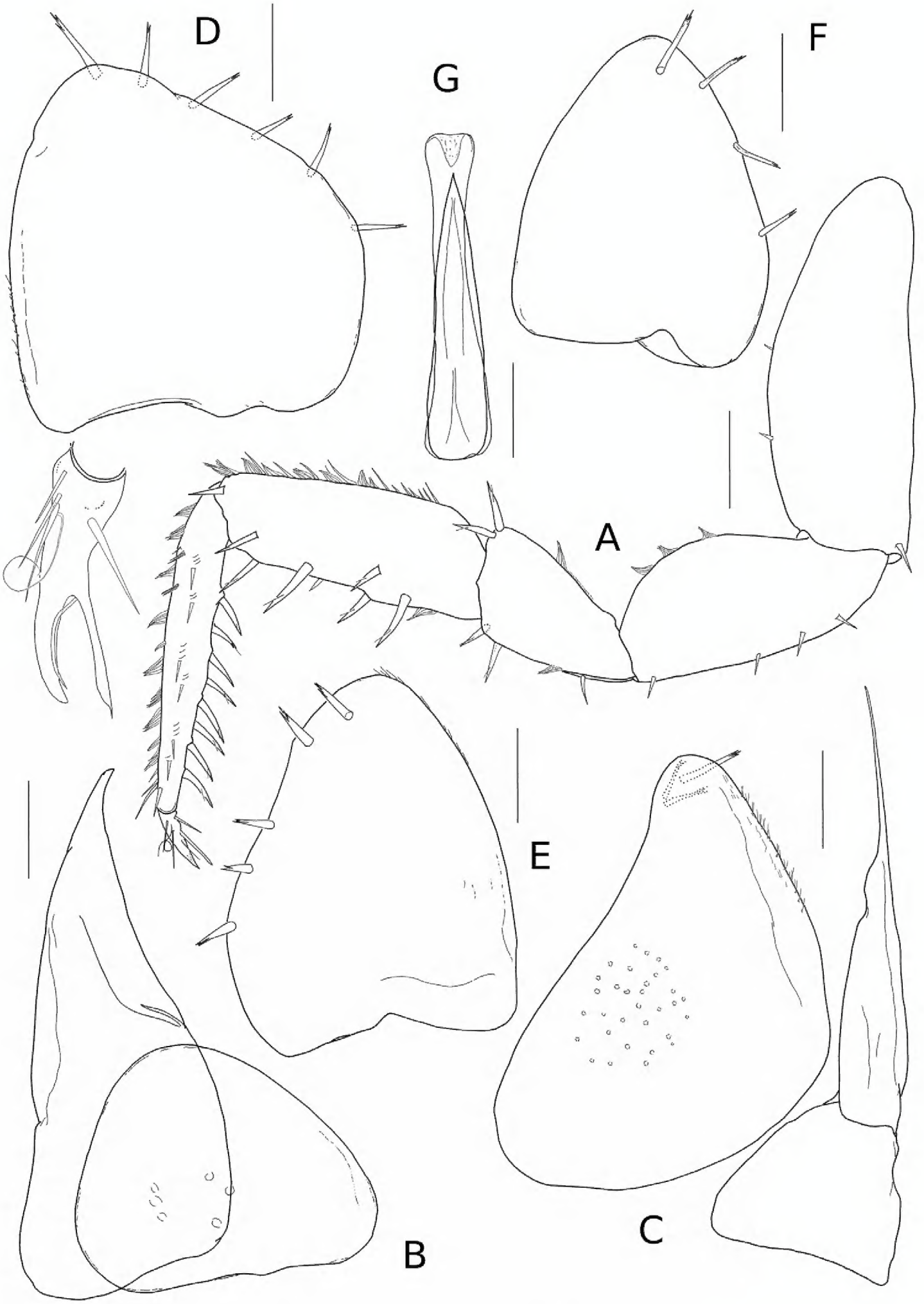

Figure 4. *Anaphiloscia simoni* Racovitza, 1907, Mallorca. **A.** Male pereopod 7 and detail of dactylus; **B.** Male pleopod 1; **C.** Male pleopod 2; **D–F.** Male pleopods 3, 4 and 5; **G.** Genital papilla. Scale bars: 0.1 mm (**A**); 0.05 mm (**B–G**).

and shape of the tergal scale-setae, a character that varies with the size (i.e. age) of the specimens. *Anaphiloscia simoni* shows sexual dimorphism on the fifth segment of the antennal peduncle, which is slightly thicker in adult males (Fig. 2G, H), whereas no differences have been observed in the pereopods. In immature individuals, the fifth peduncular article of the antenna is swollen both in males and females.

Male specimens of *A. simoni* were also compared with the published illustrations of the male of *A. sicula*. The specimen illustrated by Arcangeli (1934) is clearly an immature individual, measuring less than 2 mm, according to the stated magnification. According to the original description, *A. sicula* is distinguished from *A. simoni* only by having four penicils on the left mandible instead of three, and three versus four antennular aesthetascs (identical in shape and arrangement), as well as other minor details that may be related to growth. The shape of the male pleopods and mouthparts is identical in both species (note, for example, the outline of the maxilliped endite, the maxilla lobes, and the maxillular teeth). Therefore, *A. sicula* is proposed as a junior subjective synonym of *A. simoni*.

The specimens from Portugal studied by Vandel (1946), also identified as *A. sicula*, apparently exhibit some notable differences, such as the composition of the antennula, the dactylar morphology and the shape of the male first pleopod exopod and endopod. These Portuguese specimens may belong to a different, undescribed species. To confirm this, direct comparison with specimens from Mallorca and the eastern Iberian Peninsula is necessary.

Genus *Paractenoscia* Taiti & Rossano, 2015

Type species. *Paractenoscia cavernicola* (Taiti and Rossano 2015, p. 2082–2086; figs 9–11), by monotipy and original designation.

Diagnosis. Cephalon with suprantennal line, lacking frontal line; first antenna with fusiform aesthetascs; no visible gland pores on tergites; one line of small noduli laterales per side; pleon distinctly narrower than pereon with epimera adpressed; pleotelson semi-circular; mandibles with completely dichotomized molar penicils and with scales; maxillule with pectinate teeth; maxilliped endite without penicil; pleopods without lungs; and uropods with endopod and exopod inserted almost at the same level (see also Taiti and Rossano 2015, p. 2081–2082).

Paractenoscia sendrai sp. nov.

https://zoobank.org/6B88A0FA-7F87-4AF2-B62F-394C1A34CFD2
Figs 5–7

Type material. ***Holotype*: Spain – Balearic Islands** • ♀; **Cova de Sa Caperulla** (Portinatx, Eivissa); 25.II.2007; leg. Alberto Sendra; MBCN 31453. ***Paratypes*:** • 1 ♂ divided into 2 microscope slides; MBCN 31454-1, MBCN 31454-2 • 4 ♀♀; same data as for the Holotype; MBCN 31455, MBCN 31456, MBCN 31457, MBCN 31458.

Description. Maximum length observed: male: 5.8 mm; female: 6 mm. Body outline as in Fig. 5A, without traces of pigment in the preserved specimens. Dorsum covered with cup-shaped scale-setae (Fig. 5D), irregularly arranged except for posterior transverse rows on pleon-tergites (Fig. 5B, H); some marginal sail-like setae (Fig. 5D). *Noduli laterales* very small, all situated near the posterior margin of pereon-tergites (Fig. 5C). Cephalon (Fig. 5G) with sinuous suprantennal line; anterolateral corners acute; eyes absent. Pereon-tergites 1–4 with straight posterior margins and rounded posterior corners (Fig. 5A, B); pereon-tergites 5–7 with progressively concave posterior margin and acute posterior corners; posterior tips of pereon epimera 7 long and pointed, reaching half of third pleon-tergite (Fig. 5A). Pleon (Fig. 5H) distinctly narrower than pereon; pleon epimera 3–5 not visible in dorsal view. Pleotelson (Fig. 5H) semi-circular, about 2.8 times wider than long. Uropods (Fig. 5H) with endopod and exopod inserted almost at the same level; exopod about 3.5 times longer than endopod. First antenna (Fig. 5E) three-jointed; last article bearing 5 fusiform aesthetascs, 2 distal and 3 subdistal; second article shorter than first and third. Second antenna (Fig. 5F) long, extending backwards to reach the anterior half of pereon-tergite 4; flagellum three-jointed, slightly longer than the fifth peduncular article; flagellar articles subequal, with 3 aesthetascs on second article; fifth peduncular article not swollen. Mandibles with fully dichotomized molar process; left mandible (Fig. 6A) with three setae on molar process, 2+1 free penicils and a row of short scales; right mandible (Fig. 6B) with four setae on molar process and 1+1 free penicils and a row of short scales. Maxillule (Fig. 6C) outer branch with 4+6 teeth (4 pectinate) and single strong seta on caudal face of basis; inner branch without posterior tip, setose posterior margin and two subequal penicils. Maxilla (Fig. 6D) with subequal width lobes; inner lobe with some basal verruca-like structures, about 10 sensilla at apex and 9–10 thickened setae on medial margin; outer lobe finely setose, with a row of thickened setae near the medial margin. Maxilliped (Fig. 6E), endite without penicil, and one transverse row of fine setae on frontal face; palp with distal setae short. Pereopods *dactyli* (Fig. 7B) with simple inner claw and enlarged claw-like ungual seta. Pleopods without respiratory structures.

Male: Pereopod 1 (Fig. 6F) and Pereopod 7 (Fig. 7A) without sexual modifications. Pleopod 1 (Fig. 7C), exopod triangular, slightly wider than long, with rounded tip and without marginal setae or spines; endopod with bent distal half, with apical row of fine spines. Pleopod 2 (Fig. 7D), exopod triangular with straight inner margin and slightly concave outer margin with some setae; endopod flagelliform, about 1.4 times longer than exopod. Pleopods 3–5 as in Fig. 7E–G. Genital papilla (Fig. 7H) distally bifurcate.

Etymology. Named after the Spanish biospeleologist and entomologist Alberto Sendra-Mocholí for his contributions to the subterranean biology and as the first collector of the new species.

Remarks. This new species is distinguished from *P. cavernicola* by the following characters: pereopods *dactyli* with an enlarged ungual seta versus enlarged inner claw, genital papilla distally bifurcate, differences in the shape of scale-setae, and pereon epimera 7 with long posterior tips reaching half of the third pleon-tergite.

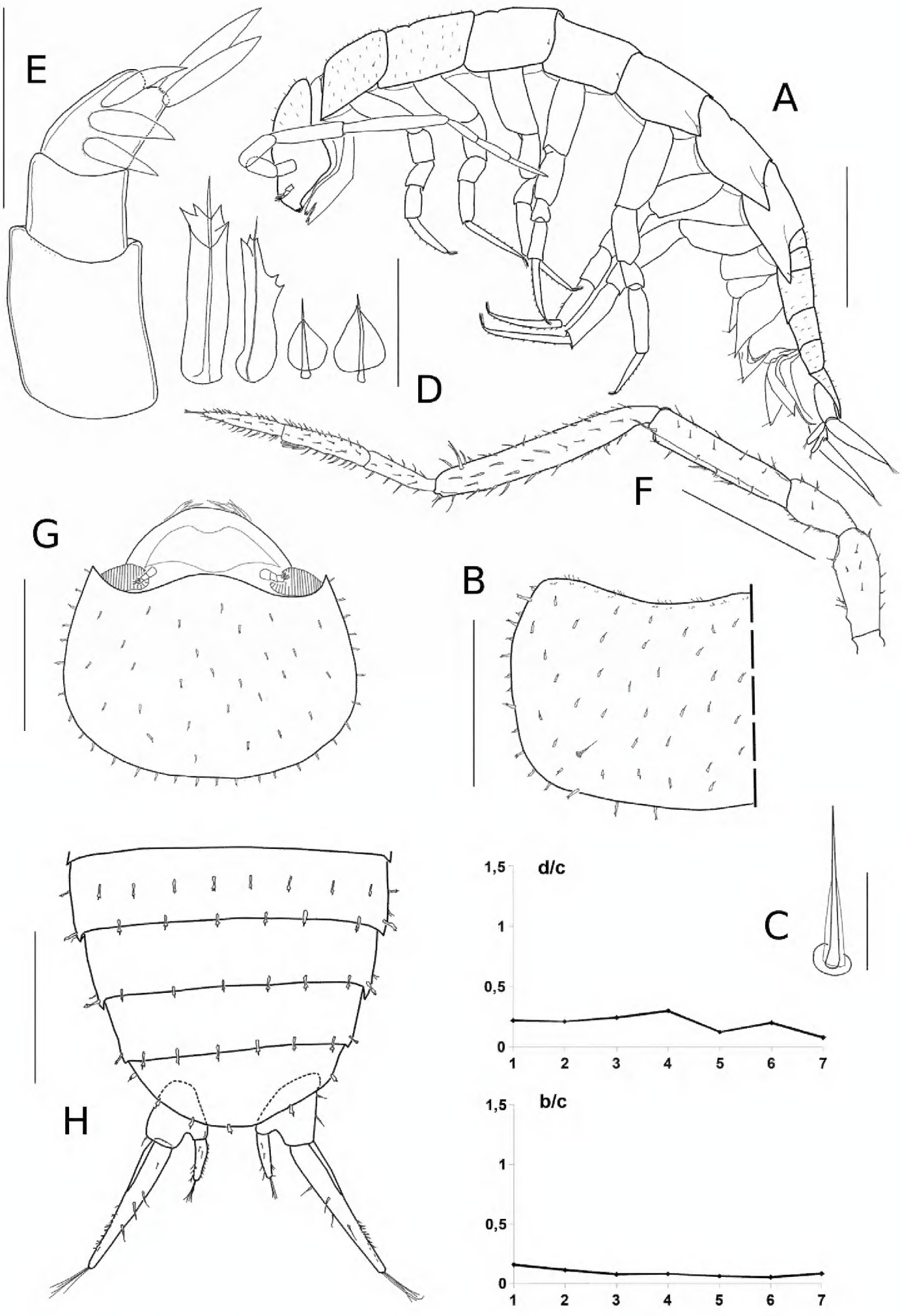

Figure 5. *Paractenoscia sendrai* sp. nov. **A.** Habitus of female paratype; **B.** First pereon-tergite (left half); **C.** Isolated *nodulus lateralis* and d/c-b/c index; **D.** Dorsal (left) and marginal (right) scale-setae; **E.** First antenna; **F.** Second antenna; **G.** Cephalon; **H.** Pleon, pleotelson and uropods. Scale bars: 1 mm (**A**); 0.5 mm (**B**); 0.05 mm (**C**); 0.025 mm (**D**); 0.05 mm (**E**); 0.5 mm (**F–H**).

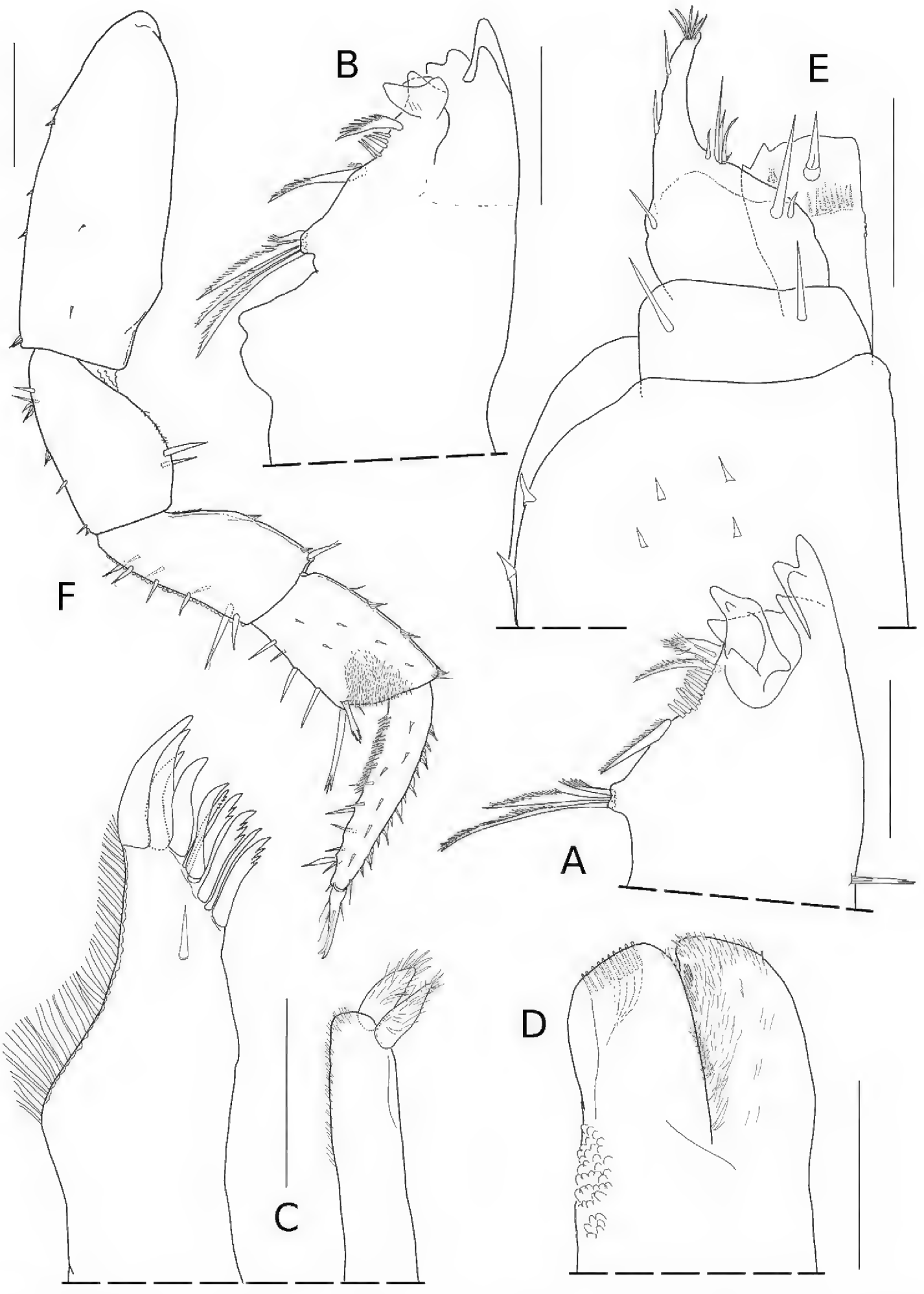

Figure 6. *Paractenoscia sendrai* sp. nov. **A.** Left mandible; **B.** Right mandible; **C.** Maxillule, outer branch (left) and inner branch (right); **D.** Maxilla; **E.** Maxilliped; **F.** Male pereopod 1. Scale bars: 0.1 mm (**A–E**); 0.2 mm (**F**).

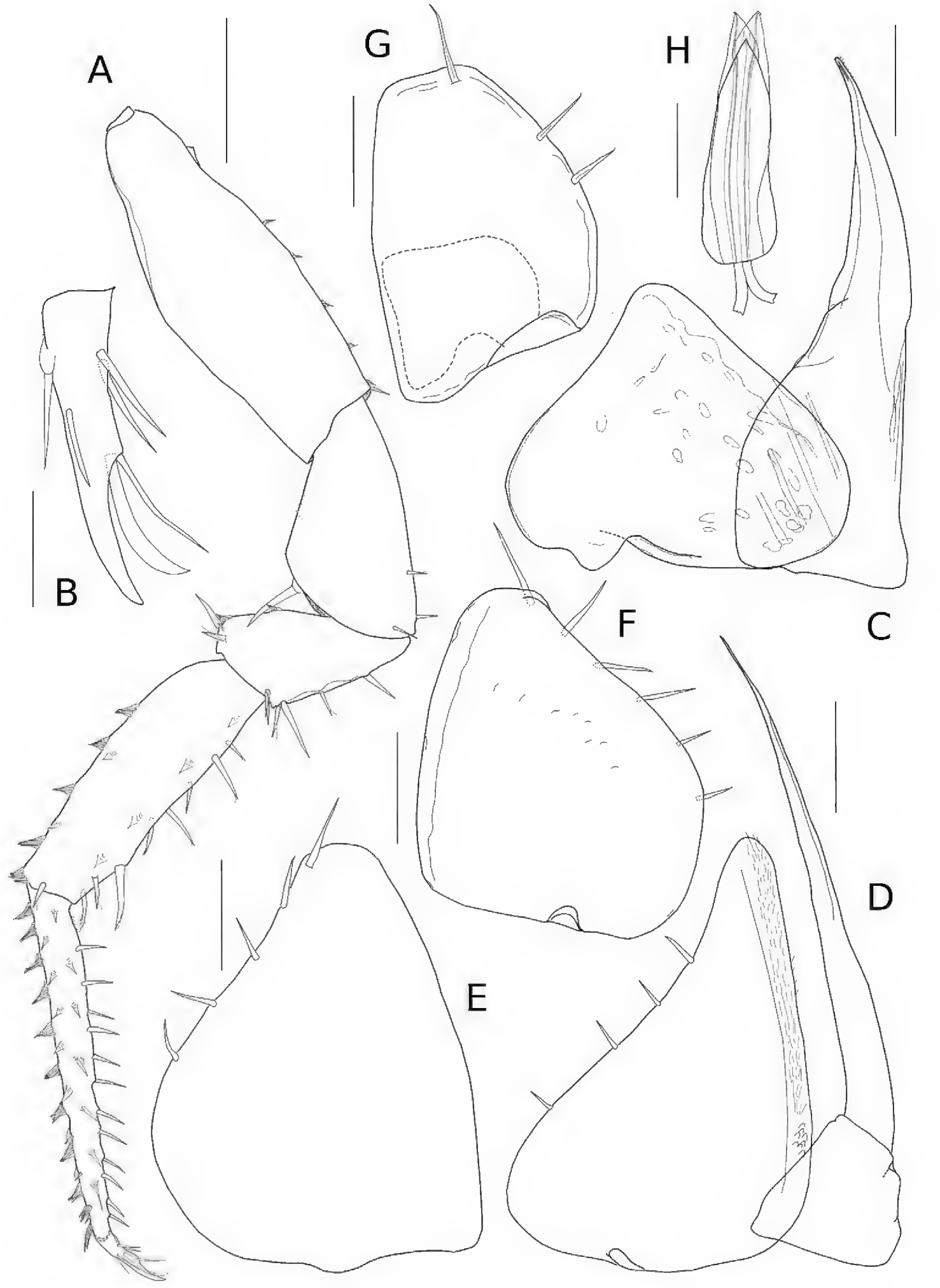

Figure 7. *Paractenoscia sendrai* sp. nov. Male paratype. **A.** Pereopod 7; **B.** Detail of dactylus; **C.** Pleopod 1; **D.** Pleopod 2; **E–G.** Pleopods 3–5; **H.** Genital papilla. Scale bars: 0.3 mm (**A**); 0.05 mm (**B**). 0.15 mm (**C–H**).

***Paractenoscia* sp. A**
Fig. 8

Material. Spain – Valencia • 2 ♀; Cueva de los Murciélagos (Vilamarxant); 2.05.2006, leg. S. Teruel. MBCN 31450, MBCN 31451.

Remarks. These specimens clearly belong to the genus *Paractenoscia*, but cannot be assigned to any of the known species of the genus. They are morphologically close to *P. cavernicola*, from which they differ in several characters, including differences in mouthpart morphology, the lower number and different shape of antennular aesthetascs, the proportions of the antennal flagellar articles, and the presence of rows of hair-like setae on the distal margins of the merus and carpus instead of scales. They also differ from *P. sendrai* sp. nov. (see above) in several characters, including the type of scale-setae, the position of the *noduli laterales*, and the structure of the dactyli. Since only female specimens are available, we prefer not to formally describe the species until additional material becomes available.

***Paractenoscia* sp. B**
Fig. 9

Material. Spain – Valencia • ♀; Cova Soterranya (Serra); 6.04.2003; leg. Sergio Montagud. MBCN 31452-1, MBCN 31452-2, MBCN 31452-3.

Remarks. The examined specimen is attributable to the genus *Paractenoscia*, but cannot be assigned to any of the known species of the genus. It is morphologically close to *P. cavernicola* and *Paractenoscia* sp. A, from which it differs in several characters, including differences in mouthpart morphology, the shape of the scale-setae, the shape and arrangement of antennular aesthetascs, the sensory equipment of the maxilla inner lobe, the number and arrangement of maxillular teeth, and the number of molar penicils in both mandibles (with scales present on the left mandible). It can be distinguished from *P. sendrai* sp. nov. (see above) by the type of scale-setae, the position of the *noduli laterales*, and the structure of the dactyli. Since only a single female specimen is available, we prefer not to formally describe the species until additional material is obtained.

Genus *Chaetophiloscia* Verhoeff, 1908

Parachaetophiloscia Cruz & Dalens, 1990, p. 94, new synonymy.

Type species. *Philoscia elongata* Dollfus, 1884.

Diagnosis. Cephalon without frontal line and with suprantennal line; left mandible with 2+1 penicils; right mandible with 1+1 penicils; both mandibles with a dichotomized molar process; maxilla inner branch lacking posterior point; maxilliped

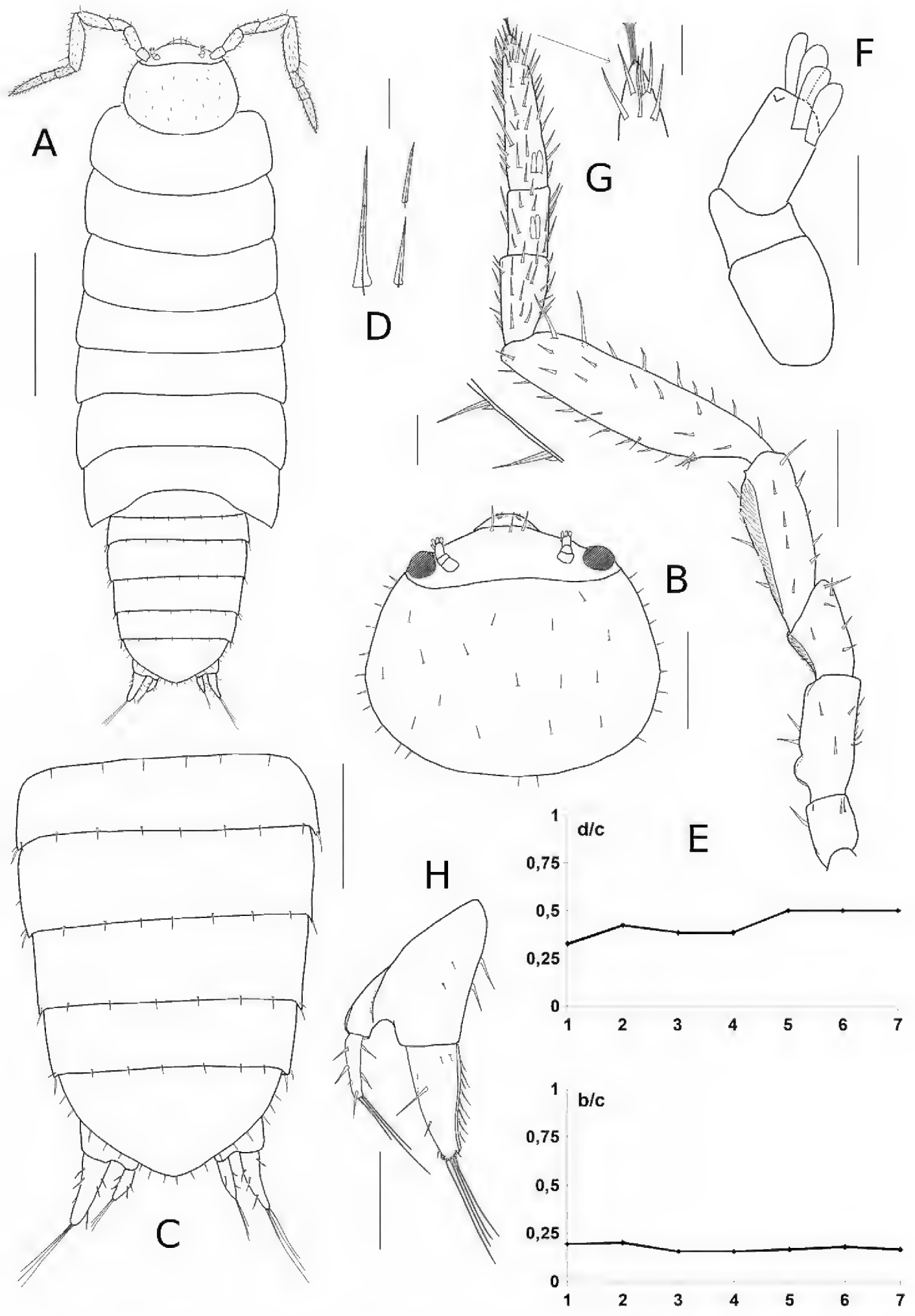

Figure 8. *Paractenoscia* sp. A, Valencia. **A.** Female habitus, dorsal; **B.** Cephalon; **C.** Pleon and pleotelson; **D.** Scale-setae and isolated *nodulus lateralis*; **E.** d/c and b/c index; **F.** First antenna; **G.** Second antenna and detail of apical cone; **H.** Right uropod. Scale bars: 1 mm (**A**); 0.2 mm (**B**); 0.25 mm (**C**); 0.025 mm (**D**); 0.05 mm (**F**); 0.1 mm (details 0.03 mm) (**G**); 0.1 mm (**H**).

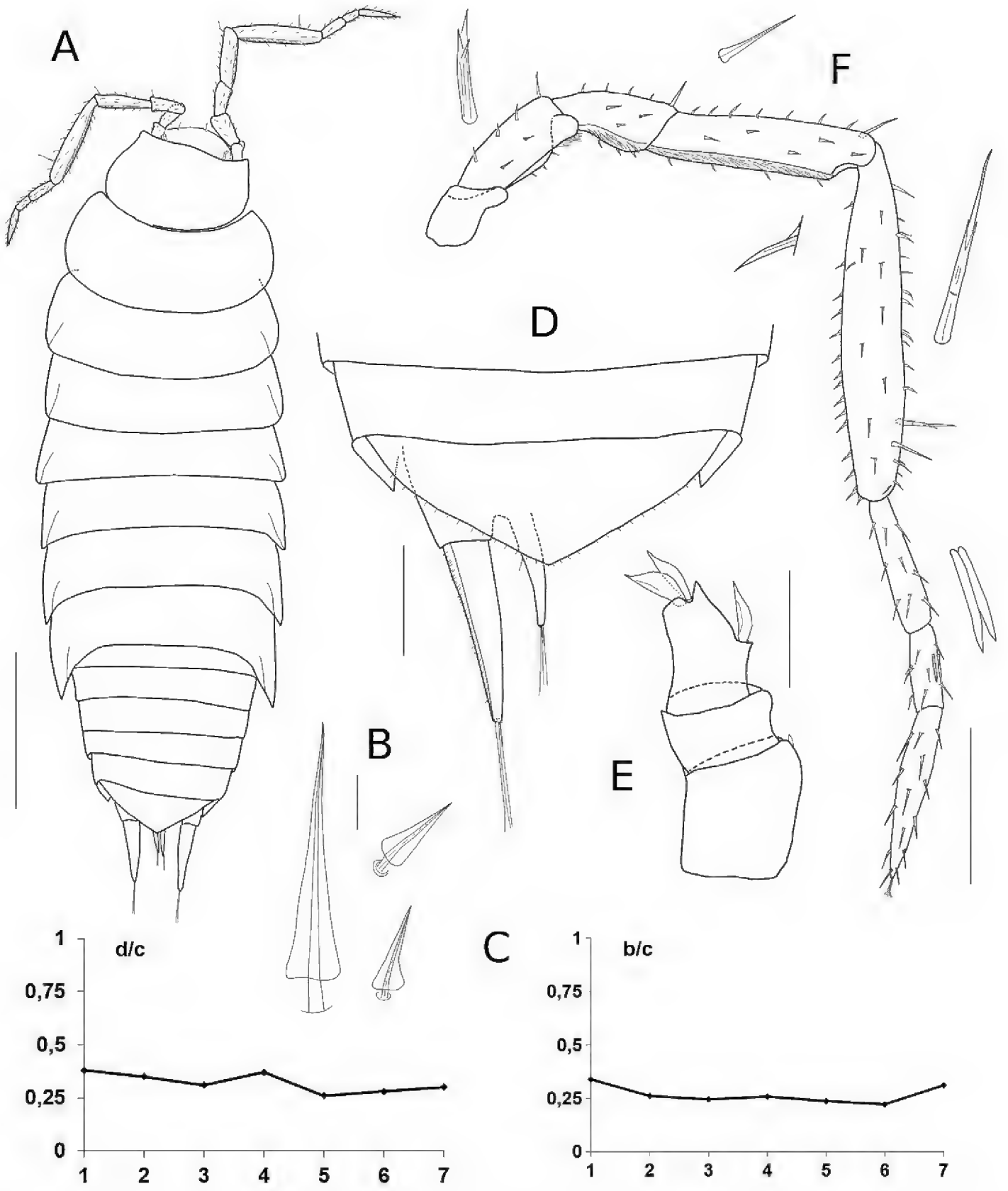

Figure 9. *Paractenoscia* sp. B, Valencia. **A.** Female habitus, dorsal; **B.** Scale-setae and isolated *nodulus lateralis*; **C.** d/c and b/c index; **D.** Last pleon-tergites, pleotelson and left uropod; **E.** First antenna; **F.** Second antenna and detail of antennal setae and aesthetascs. Scale bars: 1 mm (**A**); 0.025 mm (**B**); 0.25 mm (**D**); 0.05 mm (**E**); 0.3 mm (**F**).

endite without penicil; simple scale-setae; presence of epimeral grooves; dactyli of pereopods with outer claw and interungual seta not enlarged; pleotelson triangular; and uropods with endopod and exopod inserted at the same level. (see also Schmalfuss 1990b, p. 170).

***Chaetophiloscia levantina* (Cruz & Dalens, 1990), comb. nov.**
Figs 10, 11, 15B

Type material. ***Syntypes*** of *Parachaetophiloscia levantina* Cruz & Dalens, 1990: **Spain – Alicante** • 1 ♂ (dissected and divided into 10 microscope slides and 1 vial with ethanol); Cova del Perro (Coix); 26.10.1986; leg. Alberto Sendra; CRBA 85367 • 1 ♀ (dissected and divided into 3 microscope slides and 1 vial with ethanol); same data as for preceding; CRBA 85368.

Additional material. • 1 ♂; same locality as the syntypes, 18.11.2025; leg. Ferran Palero and Alberto Sendra.

Note. In the original description of the type species (Cruz and Dalens 1990) a Holotype was not designated. According to article 73.2 of the International Code of Zoological Nomenclature, if a Holotype (or Syntypes) is not designated in a publication prior to the year 2000, all specimens in the type-series automatically become Syntypes.

Remarks. According to the original diagnosis (Cruz and Dalens 1990), *Parachaetophiloscia* differs from *Chaetophiloscia* only in having a smaller number of penicils on right mandible and in pleotelson shape. In *Parachaetophiloscia* the right mandible bears 1 penicil and the left mandible 2+1 penicils; in *Chaetophiloscia* the right mandible bears 1+1 penicils and 2+1 on the left one (see Vandel 1962; Strouhal 1968; Shavadze et al. 2023). After examining the type series of *Parachaetophiloscia levantina* (see below), the genus type species, it was verified that such difference is probably due to an incomplete observation. In one of the preparations (male syntype) the right mandible still preserves, next to the molar process, remains of a second penicil (Fig. 10D, arrow), which was probably lost; thus, this mouthpart would also be identical to that of *Chaetophiloscia*. In the slide containing the female syntype mouthparts, the right mandible is incomplete and only *pars incisiva* remains, making comparison impossible. The remaining mouthparts (maxilla, maxillule, and maxilliped) are identical to those of *Chaetophiloscia* species (see Fig. 10C–F). Furthermore, another specimen from the type locality of *P. levantina* was recently studied, and the examination of the mouthparts of this specimen confirmed the same mandibular morphology, i.e.: 1+1 penicils on right mandible and 2+1 on the left one (Fig. 10G). Therefore, the only difference between the two genera would be the shape of the telson: subtriangular with convex sides in *Parachaetophiloscia* versus triangular in *Chaetophiloscia*. This difference is considered insufficient to justify separating the genera and here propose *Parachaetophiloscia* as a subjective junior synonym of *Chaetophiloscia*.

To facilitate comparison, the appendages preserved in good condition were re-illustrated from the slide-mounted material, including structures not depicted in the original description, as well as the complete right mandible of the newly examined specimen (Figs 10, 11).

Additional remarks. Recently, the monotypic genus *Aracenoscia* was erected, with one troglobitic species from southwestern Spain: *Aracenoscia cavernicola*. According to the original description and illustrations, *Aracenoscia* differs from *Chaetophiloscia* only in having non-adpressed versus adpressed pleon-epimera, and in

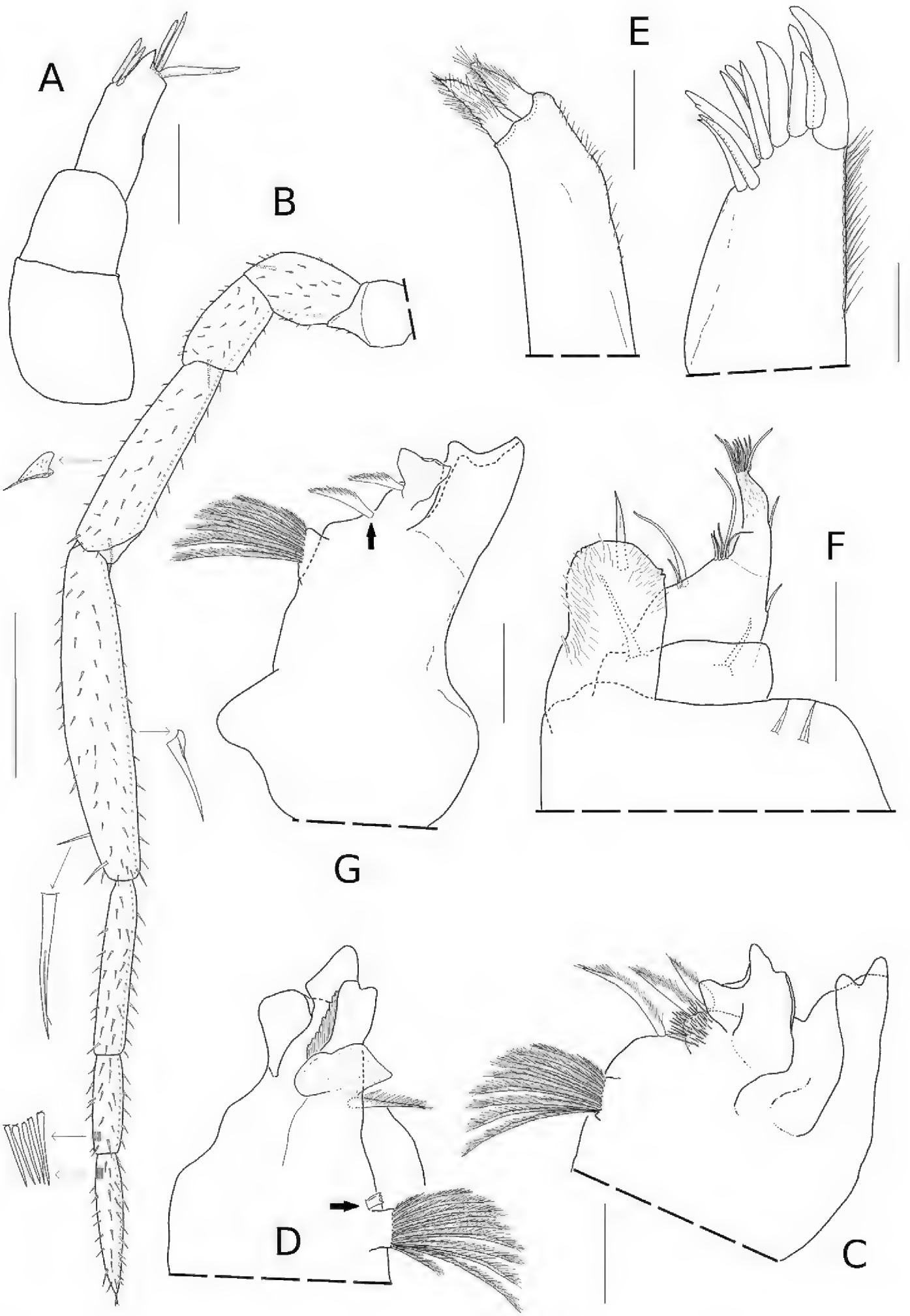

Figure 10. *Chaetophiloscia levantina* comb. nov. Male syntype. **A.** First antenna; **B.** Second antenna and details of antennal setae; **C.** Left mandible; **D.** Right mandible (arrow points remains of a lost penicil); **E.** Maxillule, inner branch (left) and outer branch (right); **F.** Maxilliped distal part (frontal). Non-type male; **G.** Right mandible (arrow points the free penicil). Scale bars: 0.05 mm (**A**); 0.5 mm (**B**); 0.08 mm (**C–G**).

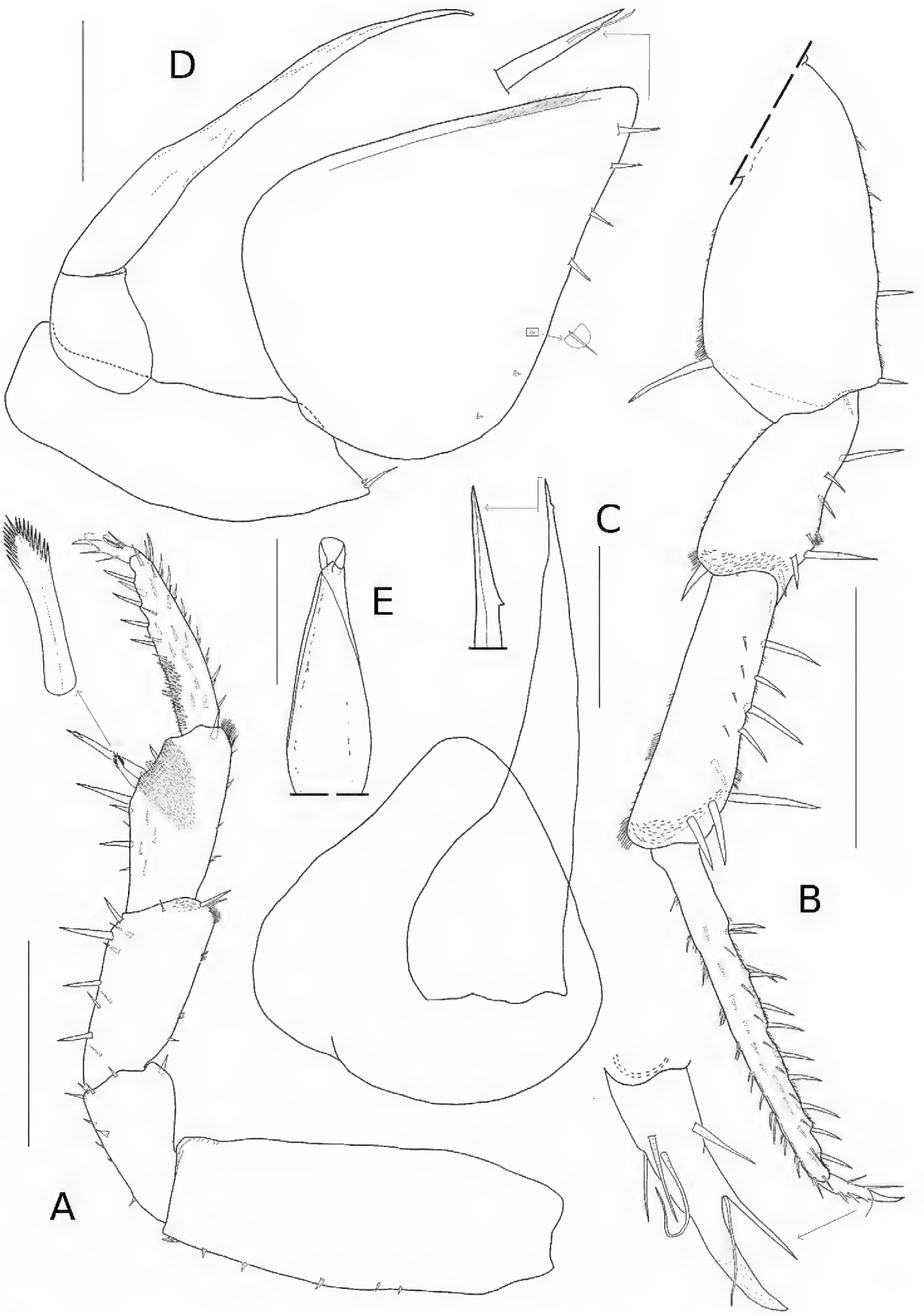

Figure 11. *Chaetophiloscia levantina* comb. nov. Male syntype. **A.** Pereopod 1 and detail of carpal seta; **B.** Pereopod 7 and detail of dactylus; **C.** Pleopod 1 and detail of endopod apical part; **D.** Pleopod 2 and detail of exopod setae; **E.** Genital papilla. Scale bars: 0.5 mm (**A, B**); 0.25 mm (**C–E**).

having the *noduli laterales* d/c maxima on the fifth pereon-tergite versus on the fourth one. The remaining morphological characters fully agree with those of *Chaetophiloscia*. Despite these similarities, the observed somatic differences (pleon shape and d/c maxima) warrant a more detailed assessment before formally proposing synonymy between the two genera.

***Iberoscia* gen. nov.**
https://zoobank.org/9EBBEC7C-F63D-4A96-8C26-EA015382333D

Type species. *Iberoscia zaragozai* sp. nov., by monotypy and present designation.

Diagnosis. Cephalon with frontal and suprantennal lines. First antenna bearing 'maraca-like' aesthetascs. No visible gland pores on tergites. One line of *noduli laterales* per side. Scale-setae consisting of a hair-like seta covered by a cup-shaped scale. Pleon distinctly narrower than pereon with epimera adpressed. Mandibles with completely dichotomized molar penicils. Maxillule with pectinate teeth. Maxilliped endite with knob-like penicil. *Dactyli* of pereopods with enlarged ungual seta. Genital papilla distally bifurcate. Pleopods without lungs. Uropods with endopod and exopod inserted almost at the same level.

Etymology. The genus name is derived from the ancient Greek Iber (Ἴβηρ), referring to the inhabitants of the Iberian Peninsula, combined with the suffix '*oscia*', after Philoscia.

Remarks. Among the European Philosciidae, *Iberoscia* gen. nov. exhibits a unique combination of morphological characters that justifies its recognition as a new genus. The combination of characters distinguishes *Iberoscia* from all the other European genera of Philosciidae. In particular, it differs from *Anaphiloscia*, *Ctenoscia* and *Paractenoscia*, by its cephalic structure, the presence of a penicil on the maxilliped endite; the position of the *noduli laterales* and in the morphology of the pereopodal dactyli. It can be further separated from *Chaetophiloscia* by mandibular structure, scale-setae, the position of *noduli laterales* and absence of epimeral groove. From *Philoscia*, *Tiroloscia* and *Lepidoniscus*, it differs in the antennular morphology, cephalic structure (i.e. presence of frontal and suprantennal lines, both absent in *Philoscia* and *Tiroloscia*, whereas *Lepidoniscus* lacks the frontal line but retains the suprantennal line), absence of epimeral grooves and pores, the maxillipedal endite with penicil, and adpressed versus expanded neopleura (see Vandel 1962; Schmalfuss 1990a, 1990b).

Within the subfamily Philosciinae, the occurrence of a penicil on maxilliped endite is present in some tropical species of this subfamily belonging to the genera *Ischioscia* Verhoeff, 1928, *Pseudophiloscia* Budde-Lund, 1904, *Androdeloscia* Leistikow, 1999 and *Heroldia* Verhoeff, 1926, among others (see Taiti and Ferrara 1980).

Finally, based on the combination of characters, *Iberoscia* gen. nov. also differs from *Aracenoscia* (see Additional remarks under *Chaetophiloscia levantina* comb. nov.).

***Iberoscia zaragozai* sp. nov.**
https://zoobank.org/AA153C0F-DA20-40F0-A8F8-3604F26D3346
Figs 12–14, 15C

"Anaphiloscia iberica", Cruz 1990 (unpublished thesis); Iberfauna 2008; *nomen nudum*.

Type material. ***Holotype*.** **Spain** – **Murcia** • ♂; Cueva del Puerto (Calasparra); 16.09.1979; leg. José Antonio Zaragoza; CRBA 85205. ***Paratypes*:** • 1 ♀; same data as for the Holotype; CRBA 85204 • 2 ♂♂; same locality as for the Holotype; 11.03.1979; leg. José Antonio Zaragoza; CRBA 85206 • 4 ♂♂, 1 ♀; same locality as for the Holotype; 16.09.1979; leg. José Antonio Zaragoza; CRBA 85207, CRBA 85208 • – **Tarragona** • 1 ♂, 2 ♀♀; Cova d'en Merla (Roda de Berà); 27.02.1966; leg. Oleguer Escolà; CRBA 85213, CRBA 85214 • 3♂♂, 10 ♀; same locality as for the preceding; 30.04.2023; leg. Adrià Miralles-Núñez; CLLG 1197. ***Additional material*:** – **Murcia** • 3 ♀♀; same locality as for the Holotype; 8.04.1977; leg. J.M. Crespo; CRBA 85209 • 2 ♂♂, 3 ♀♀; Sima del Yeso (Jumilla); 26.10.1986; leg. Alberto Sendra and José Antonio Zaragoza; CRBA 85210, CRBA 85211, CRBA 85212 • – **Valencia** • 4 ♀♀; Avenc de la Clapisa (Serra); 1.04.2018; leg. Alberto Sendra; CLLG • 2 ♂♂; 4 ♀♀; Cova del tio Melxor (Albaida); 31.05.1976; leg. Jordi Comas; CRBA 85216, CRBA 85217 • – **Castelló** • 3 ♀♀; Avenc de Serenge (Cabanes); 4.01.1970; leg. Ribes; CRBA 85220 • 1 ♂, 1 ♀; Avenc de Serenge (Cabanes); 14.03.1982; leg. Jordi Comas; CRBA 85218, CRBA 85219 • 1 ♂; Cova de les Meravelles (l'Alcora); 19.05.1975; leg. Jordi Comas; CRBA 85222 • – **Tarragona** • 1 ♂, 2 ♀♀; Cova de les Meravelles (Benifallet); 08.1990; leg. I. González; CRBA 85221 • – **Barcelona** • 1 ♂; Avenc Montserrat (Esparreguera, El Baix Llobregat); 25.01.1970; leg. Oleguer Escolà; CRBA 85215.

Description. Maximum length observed: male: 3.4 mm; female: 4 mm. Body outline as in Fig. 12A, without traces of pigment in the preserved specimens (see habitus of live specimens in Fig. 15C). Dorsum covered with numerous cup-shaped scale-setae, irregularly arranged on cephalon and first pereon-tergite, forming paramedian and posterior transverse rows on pereonites 2–7 and a single median row on pleon-tergites and pleotelson (Fig. 12A, B, E). *Noduli laterales* (Fig. 12C, D) approximately three times longer than scale-setae, all situated near the posterior margin of pereon-tergites. Cephalon (Fig. 12E) with frontal line, slightly bent medially, and curved suprantennal line, both delimiting a narrow profrons; eyes absent. Pereon-tergites 1–4 with straight posterior margins and rounded posterior corners; pereon-tergites 5–7 with progressively concave posterior margin and acute posterior corners; posterior tips of pereon epimera 7 reaching half the length of the third pleon-tergite. Pleon distinctly narrower than pereon; pleon epimera 3–5 not visible in dorsal view. Pleotelson (Fig. 12H) semi-circular with sinuous posterior margin, about 3.5 times wider than long. Uropods (Fig. 12H, I) with endopod and exopod inserted almost at the same level; exopod about three times longer than endopod. First antenna (Fig. 12F) three-jointed; last article bearing 2 distal maraca-like aesthetascs, each with three spherical terminations; second article shorter than first and third. Second antenna (Fig. 12G) with flagellum three-jointed, slightly

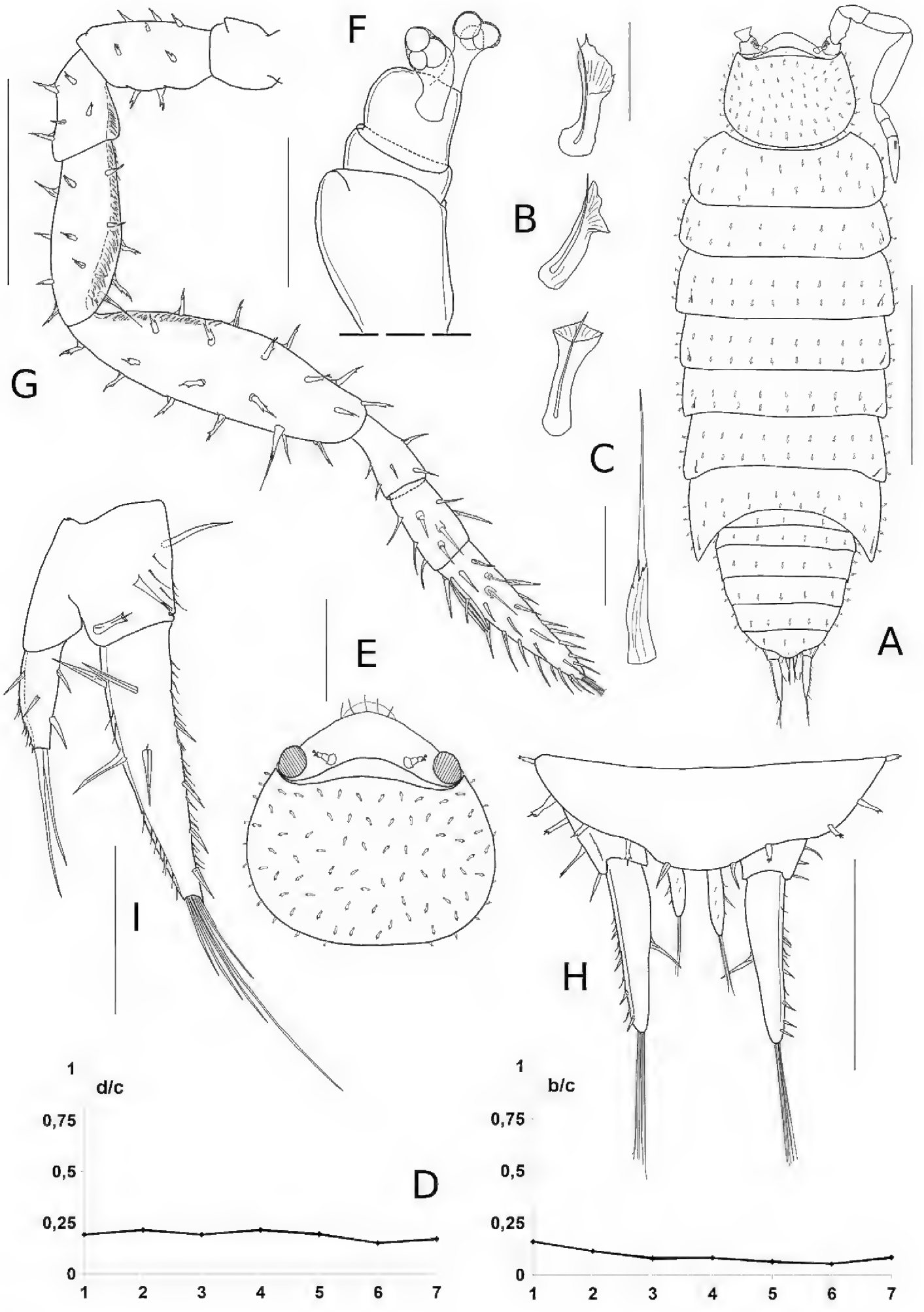

Figure 12. *Iberoscia zaragozai* gen. et sp. nov. Male paratype. **A.** Habitus, dorsal; **B.** Scale-setae; **C.** Isolated *nodulus lateralis*; **D.** d/c and b/c index; **E.** Cephalon; **F.** First antenna; **G.** Second antenna; **H.** Pleotelson and uropods; **I.** Right uropod. Scale bars: 0.5 mm (**A**); 0.02 mm (**B, C**); 0.20 mm (**E**); 0.03 mm (**F**); 0.20 mm (**G**); 0.20 mm (**H**); 0.10 mm (**I**).

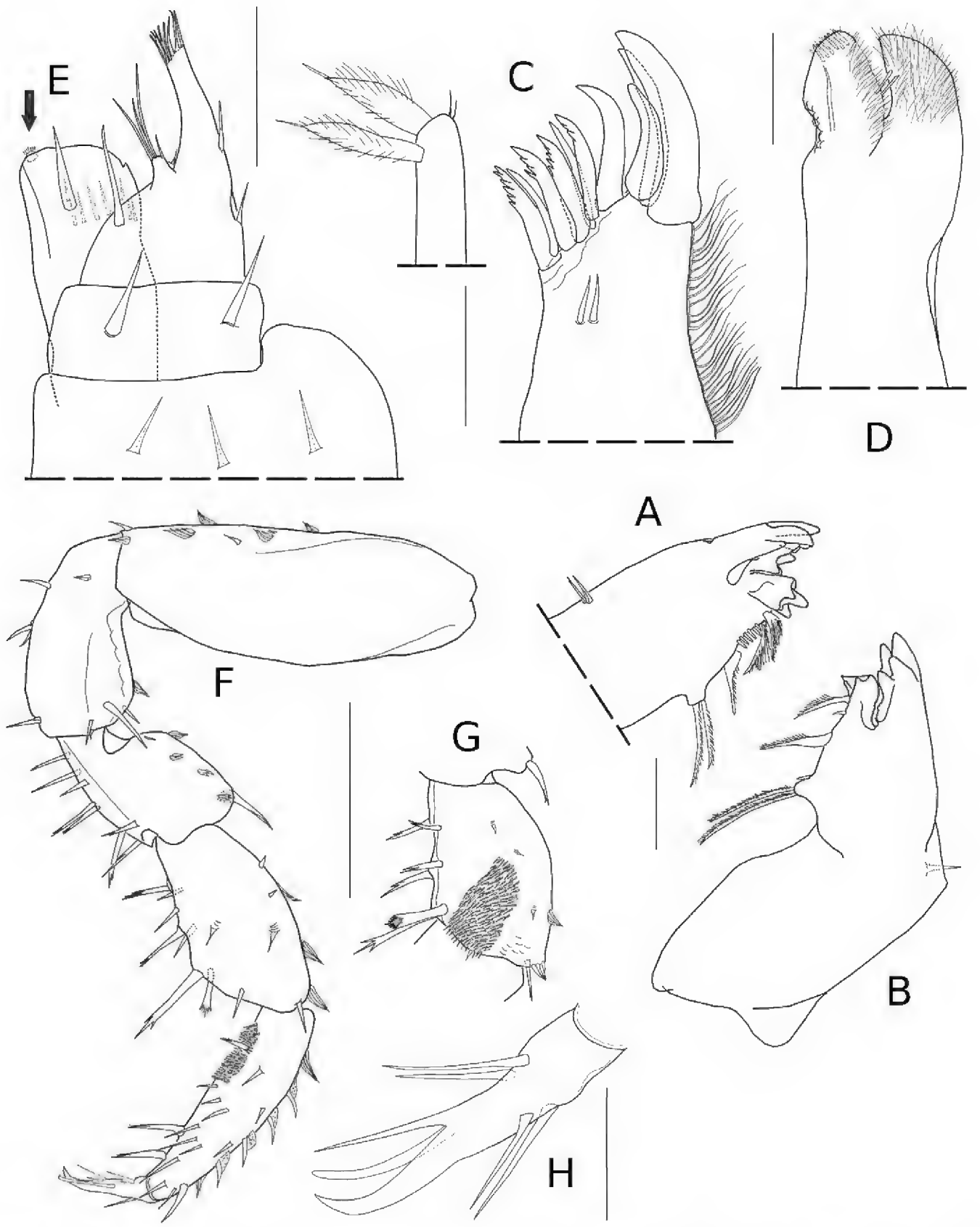

Figure 13. *Iberoscia zaragozai* gen. et sp. nov. Male paratype. **A.** Left mandible; **B.** Right mandible; **C.** Maxillule, outer branch (right) and inner branch (left); **D.** Maxilla; **E.** Maxilliped; **F.** Pereopod 1; **G.** Carpus of pereopod 1; **H.** Dactylus. Scale bars: 0.05 mm (**A, B**); 0.03 mm (**C**); 0.05 mm (**D, E**); 0.15 mm (**F, G**); 0.03 mm (**H**).

longer than the fifth peduncular article; third flagellar article longest, slightly longer than the sum of the first and second ones, bearing a row of three long aesthetascs; fifth peduncular article swollen, both in male and female. Mandibles with dichotomized molar process; left mandible (Fig. 13A) with two setae on molar process, 2+1 free penicils and a row of scales; right mandible (Fig. 13B) with two setae and a small spine on molar process and 1+1 free penicils. Maxillule (Fig. 13C), outer branch with

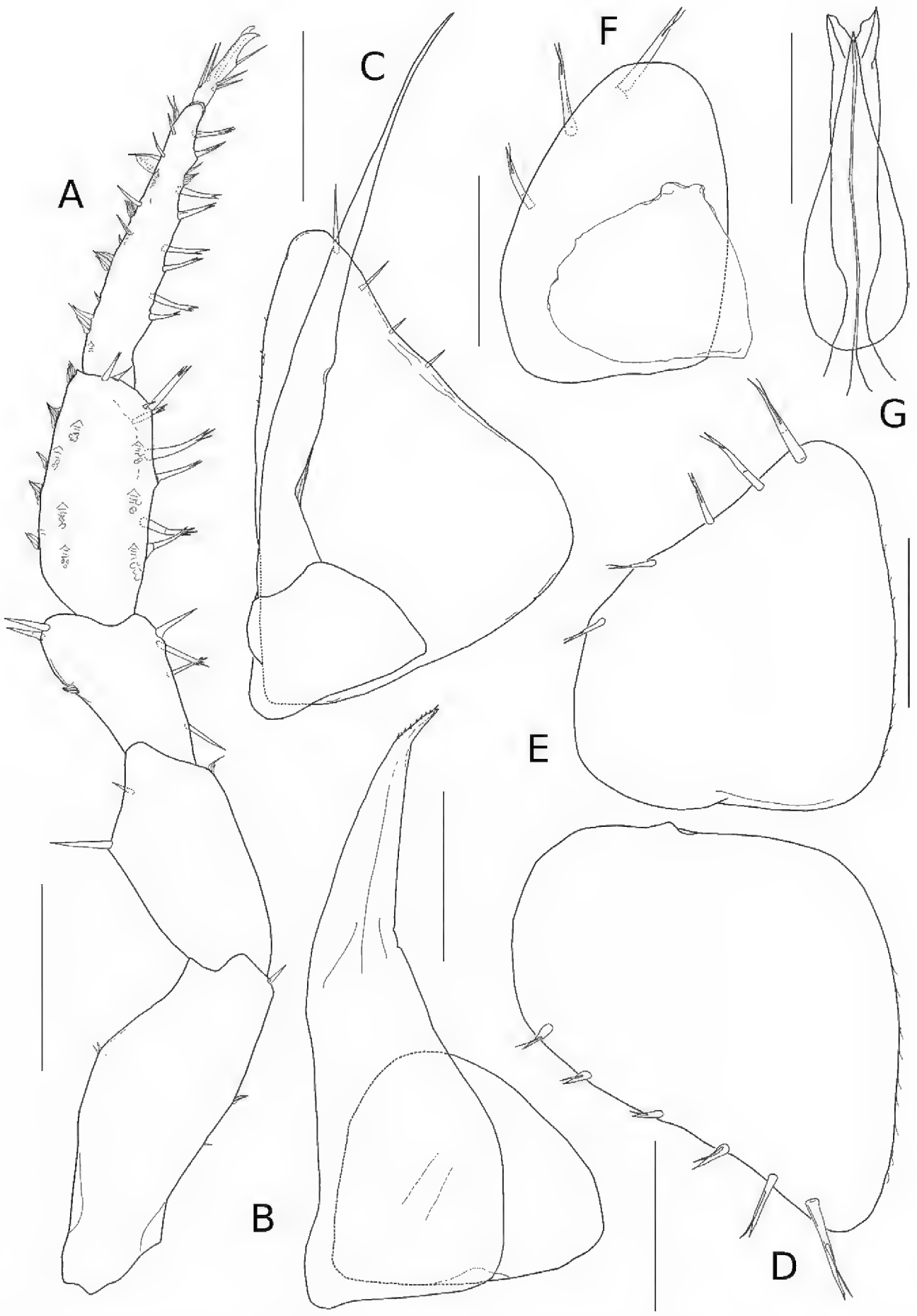

Figure 14. *Iberoscia zaragozai* gen. et sp. nov. Male paratype. **A.** Pereopod 7; **B.** Pleopod 1; **C.** Pleopod 2; **D–F.** Pleopods 3–5; **G.** Genital papilla. Scale bars: 0.15 mm (**A**); 0.10 mm (**B–G**).

4+6 (4 pectinate) teeth; inner branch without posterior tip and two long, finely setose, penicils, each with one apical thickened seta; some setae on posterior corner. Maxilla (Fig. 13D) with lobes of subequal width; inner lobe with some scarce basal verruca-like structures, about 6 sensilla at apex and 2 thickened setae on medial margin; outer lobe finely setose. Maxilliped (Fig. 13E): endite with knob-like penicil on inner corner and

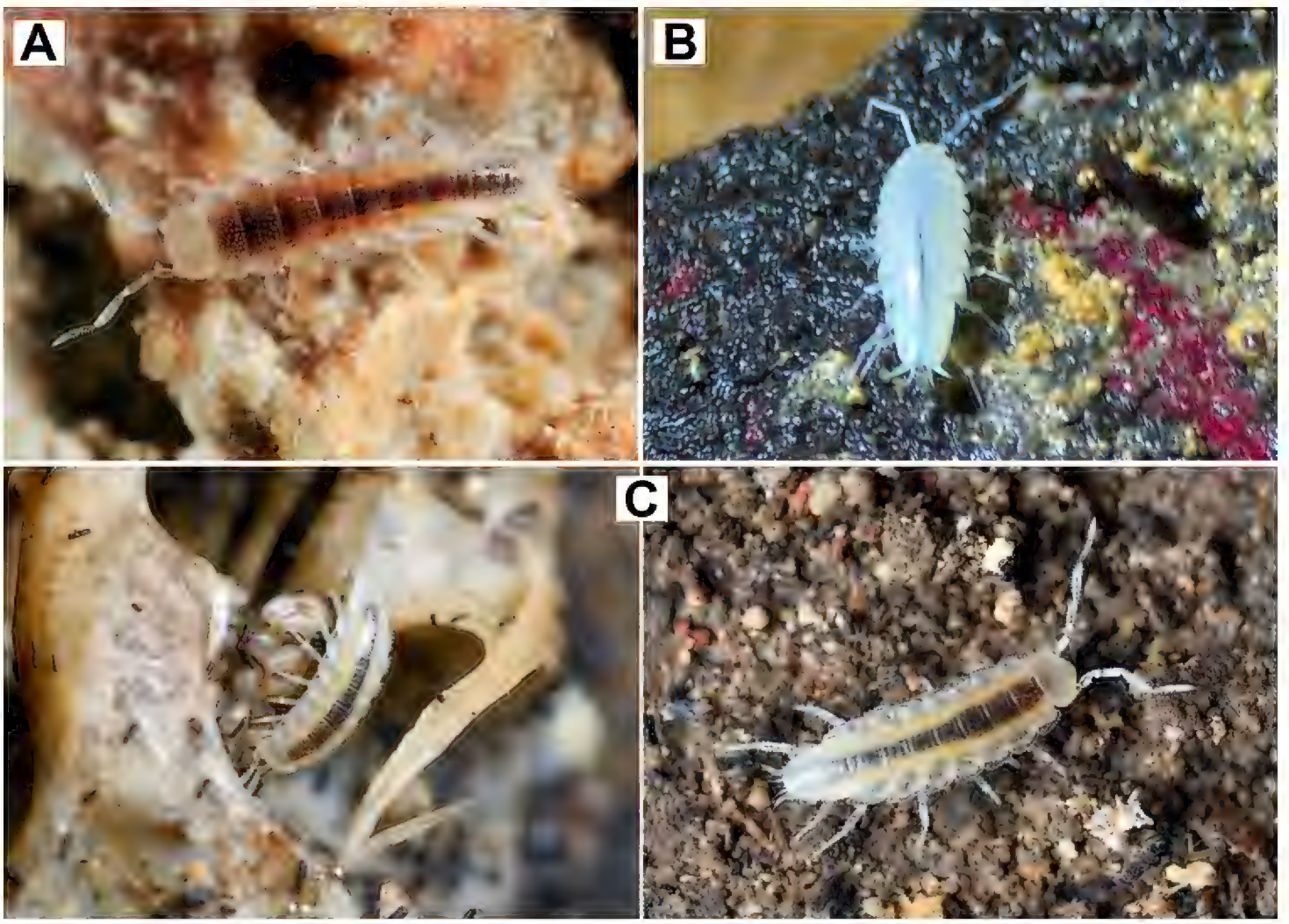

Figure 15. Live specimens photographed *in situ*. **A.** *Anaphiloscia simoni*, from Cova d'en Moret (Mallorca, Balearic Islands); **B.** *Chaetophiloscia levantina* comb. nov., from type locality (Cueva del Perro, Cox, Alicante); **C.** *Iberoscia zaragozai* gen. et sp. nov. from Cova d'en Merla (Roda de Berà, Tarragona). Photos **A** and **C**, by Adrià Miralles-Núñez, and **B**, by José Vegara Pozuelo.

transverse row of long setae on frontal face; palp with short distal setae. Pereopods *dactyli* (Fig. 13H) with inner claw simple and enlarged, claw-like, ungual seta. Pleopods without respiratory structures, as in Fig. 14B–F.

Male: Pereopod 1 (Fig. 13F, G) without sexual modifications. Pereopod 7 (Fig. 14A) without sexual modifications. Pleopod 1 (Fig. 14B) exopod almost semicircular, slightly wider than long without setae or spines; endopod with bent distal end bearing a row of fine spines. Pleopod 2 (Fig. 14C), exopod triangular, with straight lateral margins and rounded tip; outer margin with setae on distal half; endopod flagelliform, about 1.4 times longer than exopod. Pleopods 3–5 as in Fig. 14D–F. Genital papilla (Fig. 14G) distally bifurcate.

Etymology. Named after the Spanish arachnologist Juan Antonio Zaragoza-Miralles (1953–2022), as a posthumous recognition of his contribution to the knowledge of the Iberian cave fauna of pseudoscorpions and other invertebrates.

Remarks. As a species belonging to a monotypic genus, see genus remarks.

Nomenclatural remark. This species was preliminarily described in an unpublished Ph.D. thesis (Cruz 1990), under the name "*Anaphiloscia iberica*". Although there is no subsequent formal description of the species, this binomen has appeared in several checklists, datasets and technical documents online or in print (see, for example, Iberfauna 2008).

Therefore, since neither the aforementioned thesis nor any of these publications fulfils the requirements of Article 13 of the International Code of Zoological Nomenclature (for publications after 1960), "*Anaphiloscia iberica*" must be regarded as a *nomen nudum*.

Discussion

Terrestrial isopods are widely regarded as excellent biogeographic indicators due to their limited dispersal capacity. In temperate regions, troglobitic species are particularly informative, as many represent relict lineages associated with ancient faunal lineages (Taiti 2004).

Within Philosciidae, the occurrence of subterranean taxa in the Iberian Peninsula and the Balearic Islands is especially noteworthy. Although the family is predominantly tropical, mainly distributed in the Neotropical, Afrotropical and Pacific regions, it is comparatively rare in the Holarctic (Vandel 1973a, 1973b; Leistikow 2001). Paleogeographic evidence suggests that the Baetic-Rif massif once formed a land bridge between North Africa, the southern Iberian Peninsula and the Balearic promontory. In the Maghreb region, however, only one strictly troglobitic genus (*Paractenoscia*) has been recorded, which is also present in the eastern Iberian Peninsula. This distribution may reflect historical connectivity during the Messinian (see Mas et al. 2018), or possibly even earlier periods (see Moragues et al. 2021). Despite this, most African Philosciidae remain tropical, and no typically African representatives have been documented in North Africa. The presence and diversity of the genera treated here in the Iberian Peninsula and the Balearic archipelago may therefore reflect an ancient origin, consistent with Vandel's (1946) hypothesis of Gondwanian affinities for some lineages.

Cave-dwelling Philosciidae in the Iberian region appear to be geographically restricted, with records concentrated in southwestern and Mediterranean areas of the Iberian Peninsula and in the Balearic archipelago (Garcia 2023; Cifuentes and Beruete 2025). To date, no subterranean representatives have been reported from central, northern or western regions of Spain or Portugal, where the family appears to be represented by widespread epigean species. The only endemic epigean species currently recognized is *Chaetophiloscia weisi* Schmölzer, 1965, also native to the eastern Iberia (Schmölzer 1965).

The troglobitic taxa studied here occur in caves belonging to different karst sectors. With the exception of *Anaphiloscia simoni*, which is not strictly troglobitic and has a broad Mediterranean distribution, the remaining species are confined to caves of eastern and southeastern Iberia. These include the coastal ranges of Catalonia (*Iberoscia zaragozai* gen. nov. et sp. nov.), caves in the eastern Iberian System (*Iberoscia zaragozai* gen. nov. et sp. nov. and *Chaetophiloscia levantina* comb. nov.), and regions associated with the Baetic-Balearic promontory, extending into the Rif (*Paractenoscia sendrai* sp. nov. and *Paractenoscia* spp.). The recent description of *Aracenoscia cavernicola* from the southwestern Iberian-Variscan massif is particularly noteworthy, as this karst region may represent one of the earliest centers of troglobitic arthropods diversification in the Iberia (Sendra et al. 2023).

From a systematic perspective, resolving relationships within Philosciidae remains challenging. Many genera are monotypic, which may reflect the difficulty of identifying

stable diagnostic characters. A review of the extensive literature reveals that several traits traditionally used to delimit genera (see Taiti and Ferrara 1980) (e.g., dichotomized versus semi-dichotomized mandibular molar processes, position of *noduli laterales*, entire versus pectinate maxillary teeth) appear to be variable within genera. In addition, comparisons are often hindered by incomplete original descriptions. Although molecular data could help clarify these relationships, such data remain scarce for the group.

This study significantly increases the known diversity of Philosciidae in the Iberian-Balearic region. The recognition of previously overlooked or misidentified cave-dwelling species suggests that regional diversity has been underestimated and highlights the need for further integrative taxonomic work.

Acknowledgments

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